Is the Dark Triad Better Studied Using a Variable- or a Person-Centered Approach? An Exploratory Investigation

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Abstract

Despite Allport's early call to study personality as a coordinated system of traits within individual rather than separate traits, researchers often assume personality variables are largely distinct, independent characteristics. In the current research, we examined the usual assumption that Dark Triad traits (narcissism, psychopathy, and Machiavellianism) are best studied using a variable-centered (dimensional), rather than a person-centered (taxonic), approach. Results showed that a variable-centered approach is appropriate in understanding the Dark Triad, and yet individuals scoring high on one Dark Triad dimension also tend to score high on other dimensions. Based on these results, we concluded that it is appropriate to study individual differences in the Dark Triad (inferences based on persons) by capturing the common variance among the three traits using a variable-centered approach, rather than treating these traits as independent or uncoordinated characteristics.

Introduction

Drawing on apparently distinct research traditions, Paulhus and Williams [1] grouped three personality concepts that capture individual differences in malevolent qualities. These concepts were collectively named "the Dark Triad." Upon publication of Paulhus and Williams [1] the concepts have gained widespread interests, as seen in the large number of empirical investigations of their utility in predicting human behavior [2–6]. Later, as an important piece of research in this area, Jonason, Li, Webster, and Schmitt [7] extracted the common variance among the three concepts to capture the Dark Triad, potentially implying that measures for the three concepts represent a composite. Some subsequent work have followed the same methodological practice [8–10].

The concepts included in the Dark Triad are the subclinical traits of narcissism, psychopathy, and Machiavellianism. Narcissistic individuals are characterized by their highly positively inflated but unrealistic self-views [11]. This excessive self-aggrandizement is usually maintained by intrapsychic (e.g., fantasizing about power; [12]) and interpersonal strategies (e.g., using their relationships in the service of the self; [11]). Psychopathy is described as a personality and developmental disorder that features reduced guilt, impaired empathy, and salient anti-social behaviors [13, 14]. People high in psychopathy tend to be impulsive, non-empathetic,

egocentric, with minimal emotional responsiveness to threatening stimuli [1, 15, 16]. Machiavellianism denotes the tendency to exploit others to one's own advantage in a manipulative, cynical, and insincere interpersonal manner [17–19]. Individuals with high levels of Machiavellianism tend to employ exploitative tactics [20], by adopting strategies that maximize self-interest [21].

As pointed out by past researchers such as Foster and Campbell [22], scholars in clinical and personality fields adopted different approaches to examine pathological personality traits. Personality psychologists took a variable-centered (or dimensional) approach in the study of personality, assuming the variables as continuous [22], such as isolating the influence of one continuous variable from another on predicting the outcome variables or the interaction of two or three variables together on an outcome. With this approach, there is no uniform cutoff score on a continuous variable that differentiates normal from pathological individuals, and individuals do not differ in type, but only in degree.

In contrast, clinical psychologists typically took a person-centered (or taxonic) approach to personality disorders [23], with the main goal of developing diagnostic criteria in order to identify individuals at risk of psychological conditions, classify individuals into groups, and prescribe appropriate treatments based on group memberships [24–26]. In trait research related to the Dark Triad, narcissism and psychopathy have a strong tradition as categorical variables, suggesting that within each of these conditions individuals are classified as members of qualitatively distinct subgroups (e.g., [27,28] for narcissism; [25, 29–32] for psychopathy).

When personality psychologists extended the examination of these pathological traits from special population (e.g., criminals) to normal population (e.g., students), they did not necessarily adopt the idea that these conditions, in themselves or in combination of each other, are taxonic in nature, but assumed them as dimensional constructs [33]. Typically, personality researchers adopt the Dark Triad as three distinct variables. They then examine the relationship between each measure and its potential antecedents, correlates, and consequences [34–36]. This practice was also observed when scholars examined the Dark Triad with a neurological perspective. Recent findings through neurobiology theories (e.g., Reinforcement Sensitivity Theory, Gray [37] revealed that all three Dark Triad traits were respectively positively correlated with negative affectivity, reward sensitivity, and dysfunctional impulsivity [38]. Although less common, some researchers treat the three Dark Triad constructs as one [7], averaging to create a composite Dark Triad score [39]. This approach is supported by empirical studies demonstrating that the Dark Triad constructs load on a single latent factor [7, 40–42].

Without criticizing any of the previous studies, we are aware of no empirical or theoretical basis on which the structure of the Dark Triad should be dimensional or taxonic in nature and whether Dark Triad should be studied using variable-centered or person-centered approach. Statistically, a critical assumption of the variable-centered approach is the underlying homogeneity of the population regarding the construct's trait structure [43]. If a causal relationship exists between the predictors (such as the Dark Triad) and the outcome (such as psychological health), the process is assumed to be universal among members of the same population [44, 45]. In other words, members of the same population are only *quantitatively* different from each other; the process of how they relate to the outcome is *qualitatively* similar [46].

If the assumption of population homogeneity is violated, a variable-centered approach will not be able to provide an accurate picture of the analytic findings [47]. Indeed, many psychological conditions, such as anxiety and borderline personality traits, have been empirically shown that they were better operationalized using person-centered approaches (i.e., individuals can be classified into different subtypes of the same disorder [48]), although empirical research still severely lags behind in discovering potential subtypes within other clinical or personality traits.

On the conceptual level, personality characteristics may not always be best studied using a variable-centered approach. As pointed out by Allport [49], different psychological processes, behaviors, and traits function as a coordinated system, rather than isolated from each other. If we wish to examine personality constructs, a person-centered perspective may be desirable, with the unit of analysis being the person, not a trait (see Asendorpf [33], for an insightful discussion). Unfortunately, researchers often assume personality variables are distinct entities from each other [33], with the occasional exception that two or more variables are studied as interacting entities (i.e., moderation) to predict an outcome. Following Allport's [49,50] advice, we feel the necessity to examine how to best approach Dark Triad variables rather than assuming the Dark Triad traits are three distinct yet related constructs.

Present research

The purpose of the current research is to re-visit the research question of whether any qualitatively distinct groups exist in the Dark Triad. If the answer is affirmative, the Dark Triad should be operationalized using person-centered (taxonic) approach rather than variable-centered (dimensional) approach. Previous findings based on variable-centered approaches would be questionable to the extent that the operationalization of the construct does not accurately reflect its latent structure. Admittedly, there is a lack of theoretical work investigating the potential structure of the Dark Triad (whether it should be taxonic or dimensional), despite the fact that knowing its structure is important for its future theory development. Although some researchers prefer an empirical investigation driven by substantial theorization, in situations when this is not feasible, having empirical findings to guide future theory on the Dark Triad is often beneficial. This approach of scientific investigations can be found on the structure of personality traits [51], which was discovered using primarily factor analytic techniques rather than substantial theory development. Therefore, we make no specific hypothesis on the structure of the Dark Triad because few previous studies [52] were conducted using person-centered approaches. With a rather small sample size and subjective criteria (by examining how interpretable a cluster analytic solution is), the data of Chabrol et al. [52] seem to support a taxonic, person-centered approach in the study of the Dark Triad and a related trait, although their results are perhaps suggestive in nature. Therefore, because of insufficient research in this area, we have employed a larger sample size and will allow statistical analyses to provide the answer regarding the best approach to study Dark Triad traits.

Confirmatory factor analysis (CFA) is a variable-centered approach by which researchers can specify the hypothetical factor structure a priori and determine the best-fitting factor structure [53]. CFA extracts the common, shared variance among a set of observed indicators, such as participants' scores on Dark Triad constructs. Variable-centered approaches such as CFA are best employed when individuals differ only quantitatively (i.e., individuals without distinct Dark Triad profiles). Latent profile analysis (LPA), in contrast, is a person-centered approach that shifts the focus of investigation from variables to individuals. LPA aims to identify groups of individuals with unique profile characteristics (e.g., one group may be high on all three constructs, whereas another may be high on one or two). Compared to traditional methods of person-centered research (e.g., cluster analysis), LPA has several advantages: (a) LPA uses maximum likelihood estimation to obtain estimated probabilities of class membership; (b) LPA employs latent variable modeling to reduce measurement error; and (c) LPA calculates fit indices to facilitate model selection [54].

A person-centered approach best represents the data if individuals differ on profile characteristics. However, person-centered approaches alone assume homogeneity within each group (i.e., members assigned to the same group do not differ), which may be unrealistic. Therefore,

we also employed factor mixture modeling (FMM), which relaxes the assumption of within-group homogeneity in LPA. Individuals assigned to a group are allowed to differ quantitatively. In this sense, FMM analysis is a "best-of-both-worlds" approach, combining the benefits of variable- and person-centered approaches.

The ultimate solution will be determined jointly by fit indices and profile shape offered by CFA, LPA, and FMM. Fit indices provide an objective measure of the soundness of a solution, but relying solely on them invites the problem of overfitting the data. Therefore, we take the following approach: If the LPA or FMM solutions reveal profiles with qualitatively distinct shapes, they would support the existence of categorically or qualitatively heterogeneous groups of individuals in the data (person-centered approach). If the solutions show profiles parallel to each other, it would suggest only quantitative differences (variable-centered approach). Finally, to examine if personal-centered approach may show a substantial advantage above and beyond variable-centered approach in the study of the Dark Triad, we conducted a nomological network investigation by correlating the Dark Triad with external constructs: Big Five and social dominance orientation (SDO). Big five and SDO were chosen because they are common correlates of Dark Triad traits [10]. If person-centered approach shows additional value beyond the variable-centered approach, the former may be able to reveal non-linear or non-stepwise relations with external correlates (e.g., all profiles share low SDO or agreeableness values except the most severe class of Dark Triad). To ensure the quality of our respondents' answers, we included additional items requesting participants to select a particular response in our survey. Those who failed to follow our instructions were regarded as potential careless respondents and excluded from our analyses.

Method

Participants

Data collection was approved by the Institutional Review Board (IRG) of the University of Western Ontario. We employed a large sample size, as required for LPA analysis. Participants were 1,406 undergraduates at a Canadian university in southwestern Ontario who completed a survey in exchange for partial course credit. Of the entire sample, 1,102 participants (78.38%) passed two check questions that requested them to select a particular response in the survey ('*Strongly Agree*' for one question and '*Disagree*' for another question). This type of question has been found to be helpful in screening out careless respondents [55, 56]. We included the 1,102 careful respondents so that our solution would not be distorted by inattentive responding. Finally, this dataset has been used in other research unrelated to the current study.

Measures

Participants completed survey questions about the Dark Triad, together with two other measures: Big Five personality and Social Dominance Orientation. There has long been argument that the Dark Triad consisted of a group of personality traits [57, 58], and it had the same common core as social dominance orientation [9]. Nonetheless, these arguments were examined only from a variable-centered perspective. We decided to include these additional measures in order to find out if the person-centered approach will show additional value.

Dark Triad. The Dark Triad was assessed by a short-form measure [59] of Machiavellianism (α = .75), subclinical psychopathy (α = .77), and subclinical narcissism (α = .67; Cronbach's alphas in the current study are shown in parentheses). Each subscale was measured in a 5-point Likert scale (1 = *Strongly Disagree*; 5 = *Strongly Agree*). The entire measure consisted of 28 items: Machiavellianism was measured by 10 items, and narcissism and psychopathy were each measured by 9 items. Sample items were "It's not wise to tell your secrets"

(Machiavellianism); "I like to get revenge on authorities" (psychopathy); and "I know that I am special because everyone keeps telling me so" (narcissism). Paulhus and Jones [59] also found their scales to have acceptable level of reliability in their study (αs > .73). In the current study, the inter-correlations among the three traits were not strong (all ps < .001): Machiavellianism and psychopathy: .50; Machiavellianism and narcissism: .20; narcissism and psychopathy: .23. The current version of the Dark Triad has been used in recent studies (e.g., [60–64]).

Big Five personality measures. Participants completed the Big Five personality measures (NEO domain) from the International Personality Item Pool [65]. The scale measures openness (α = .73), conscientiousness (α = .80), extraversion (α = .88), agreeableness (α = .76), and neuroticism (α = .86). Each personality construct was measured by 10 items in a 5-point Likert scale (1 = *Strongly Disagree*; 5 = *Strongly Agree*).

Social dominance orientation (SDO). Participants completed 16 items measuring their preference toward social group inequality [66], such as the legitimacy of superior groups dominating other groups. The scale (α = .90) was measured in a 7-point Likert scale (1 = *Strongly Disagree*; 7 = *Strongly Agree*).

Analysis strategies

The current study compares the results of person-centered (LPA) and variable-centered (CFA) approaches. The analyses were conducted in Mplus 7.2, with robust maximum likelihood estimator. An advantage of using a robust maximum likelihood estimator was the relaxation of strict multivariate normality as a requirement for data analysis. In addition, the Mplus program provided a list of comprehensive indices for model selection.

Following common practice, we calculated the scores of psychopathy, Machiavellianism, and narcissism by averaging scores of their corresponding items, and using these three scores as construct-level indicators in LPA analysis. LPA is very demanding in its sample size requirement. Using these construct-level indicators (as opposed to individual item scores) can decrease the number of parameters being estimated and thus alleviate the burden in achieving a stable solution.

In CFA, we constructed a model in which the scores of psychopathy, Machiavellianism, and narcissism all load onto one latent (continuous) variable. In LPA, we started with a two-profile solution, then gradually increased the number of profiles in the latent variable (i.e., the Dark Triad). A two-profile solution was conducted with 1,000 random starts with 60 iterations, in which the 250 best solutions were retained for final stage optimization. As the model becomes more complex (i.e., the number of profiles increases), the random starts increase to 2,000, with the 500 best solutions further analyzed for optimization. As LPA is known to have the problem of local maxima, all final solutions were checked to ensure successful replication of the best solution with different seeds (i.e., global maximum). Finally, the default of Mplus programme restricts the variance of indicators to be identical across profiles (e.g., in a 3-profile solution, the variance of psychopathy is constrained to be the same across all three profiles), but this assumption has been shown to be too restrictive [67], and there is usually no theoretical reason behind this assumption. Following the advice of Morin, Maïano, Marsh, Janosz, and Nagengast [68, 69], we lifted this restriction and freely estimated the variances in each profile.

In model selection, both CFA and LPA models provided a number of loglikelihood-based fit indices for this purpose, including the Akaike's Information Criterion (AIC), the Bayesian Information Criterion (BIC), and the sample-size adjusted BIC (SABIC). A lower value of these indices indicates a better solution. Although there is no infallible rule in model selection, recent simulations show that BIC performed the best at identifying the correct model, compared to many other fit indices [70, 71].

Among latent profile models, there is additional fit information to facilitate model selection. Entropy informs the researchers about classification certainty among the participants. Ranging from 0 to 1, a model with higher entropy has a higher precision in classifying participants in the specified number of profiles. Although entropy should not formally be used in model selection [72], it can potentially reflect the degree of accuracy in the classification.

Finally, to avoid overinterpreting the results, the best solution should take into account both profile patterns and theoretical rationale. When a solution shows profiles parallel with each other, the utility of conceptualizing the latent variable as categorical (i.e., latent profiles) rather than continuous (i.e., latent factor [46, 73–76]) is called into question. A parallel profile pattern suggests that each profile is only quantitatively different from each other. The fact that LPA arrives at a solution does not necessarily imply the existence of profiles at the population level. To our knowledge, there has been no empirical test examining whether the Dark Triad has different profiles, and if so, how many. Therefore, we rely mostly on fit indices and profile patterns to choose the best solution.

As a supplementary analysis, we modeled the data with a series of factor mixture models (FMM), which are a combination of factor analysis and LPA. While LPA assumes a latent construct (such as the Dark Triad) to be categorical in nature, it does not allow individuals within each profile to differ in degree. Similarly, factor analysis assumes a latent construct to be continuous in nature: It does not permit individuals to be qualitatively different. FMM, however, allows the same latent variable to be operationalized as both categorical (i.e., profiles that are qualitatively different from each other) and continuous (i.e., individuals who differ quantitatively in the trait of Dark Triad). We briefly report the results of FMM.

Finally, we related the CFA and best-profile solutions with external variables, including Big Five personality and SDO. Previous researchers have examined the relationship of the Dark Triad subconstructs with Big Five personality and SDO only from a variable-centered perspective [10]; thus it is unknown if the person-centered approach will show additional value. We examined how the LPA profiles differ on external variables using the approach of Bakk and Vermunt [77] (implemented in the Mplus program), and compared this approach to the variable-centered, examination-of-correlations approach.

Results

Latent profile analysis

We extracted a model with two profiles and then gradually increased the number of profiles to six. As shown in Table 1, the number of respondents within a given profile shrinked to about 2% as the model became more complex. To facilitate interpretation, in Fig 1 we presented "elbow plots" for AIC, BIC, and SABIC to show the gain associated with an additional profile in a solution [67]. Recall that the best solution has the lowest value on the indices. An obvious pattern was that BIC leveled off after the three-profile solution. However, the 4-profile solution identified a profile of negligible size (2.18% or 24 respondents), potentially indicating a problem of over-extracting information if more profiles were requested. Indeed, the 5- and 6-profile solutions did not converge properly even with a large number of random starts (20,000), indicating possible over-extraction. Based on BIC value, entropy and profile size, we proceeded to examine the profile pattern in the 3- and 4-profile solutions.

As shown in Fig 2, for both 3- and 4-profile solutions, the profiles within a solution were largely parallel: they differed only quantitatively, not qualitatively. Also apparent was that the values on narcissism were very similar for some profiles, suggesting that of the three subconstructs, narcissism was least able to differentiate the profiles. (We also inspected the shape of the 2-profile solutions; similar parallel patterns were found; results not shown here.) We concluded that the LPA solutions did not strongly support qualitatively distinct profiles in the

Table 1. Fit information of latent profile analysis (LPA), confirmatory factor analysis (CFA), and factor mixture modeling (FMM).

	AIC	BIC	SABIC	Entropy	Percentage of Respondents in Each Profile					
					Profile 1	Profile 2	Profile 3	Profile 4	Profile 5	Profile 6
LPA										
2-profile	5050.08	5115.14	5073.85	.58	53.72%	46.28%				
3-profile	4964.46	5064.56	5001.03	.65	65.43%	13.98%	20.60%			
4-profile	4927.77	5062.90	4977.14	.68	11.43%	2.18%	49.18%	37.21%		
5-profile		inadmissible solutions								
6-profile		inadmissible solutions								
CFA	4974.60	5019.64	4991.05	-	-	-	-	-	-	-
FMM										
2-profile		inadmissible solutions								
3-profile		inadmissible solutions								
4-profile		inadmissible solutions								

Note. We attempted all four types of FMM models, as described in Clark et al. [43], for each profile analysis, but all solutions were not admissible.
N = 1,102.

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data. To ensure this interpretation was correct, we proceeded to examine the CFA solution and compared the models in terms of their fit indices. A CFA solution with comparable or better fit would support our preliminary explication.

Confirmatory factor analysis

CFA results replicated previous research that Machiavellianism and psychopathy had sizable standardized factor loadings on the latent variable, Dark Triad (.65 and .77), and narcissism had the weakest loading (.30). This was consistent with the previous finding that
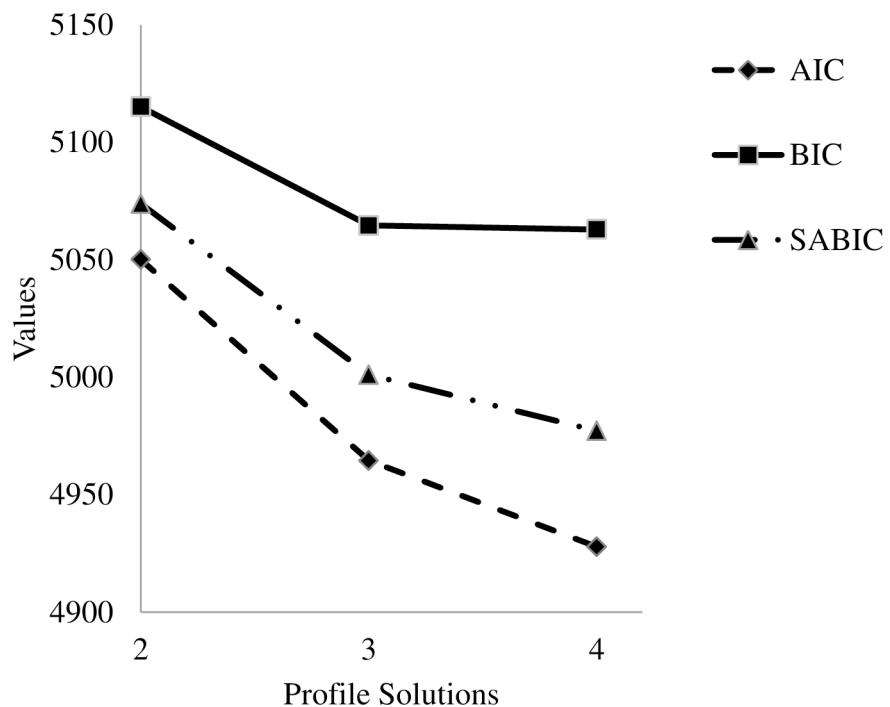

Fig 1. Elbow plot for loglikelihood-based indices among the LPA solutions.

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3-Profile Solution
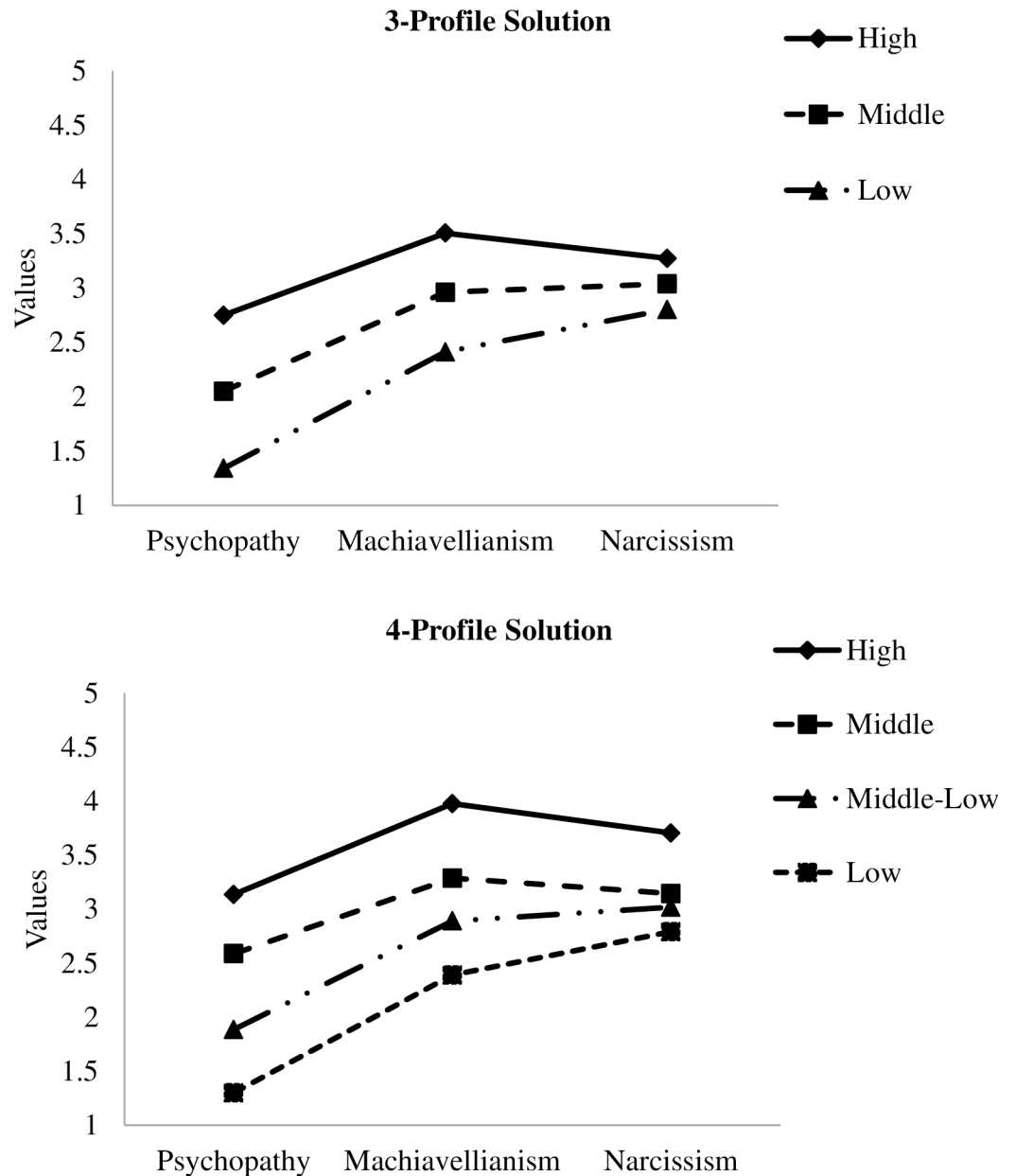

4-Profile Solution

Fig 2. Selected latent profile solutions.

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Machiavellianism and psychopathy had a closer relationship with each other than with narcissism [1]. Note that the CFA model was a just-identified model (i.e., zero degrees of freedom); thus chi-square-based fit indices, such as comparative fit index (CFI) and root mean square error of approximation (RMSEA), were not possible.

However, AIC, BIC, and SABIC were based on loglikelihood statistics and were provided in Table 1. Compared to the best LPA solutions (3-profile and 4-profile), the CFA model had the lowest BIC. Its AIC and SABIC values were lower than the 3-profile solution and but slightly higher than the 4-profile solution. Because, as noted, the LPA solutions showed largely parallel profiles (Fig 2), the data overall suggested that the Dark Triad was better represented as a dimensional than a taxonic variable.

Factor mixture modeling

To complete the analysis, we attempted to conduct FMM, which simultaneously models the Dark Triad as a continuous variable (as in CFA) and as a categorical variable (as in LPA). According to Clark, Muthén, Kaprio, D'Onofrio, Viken, and Rose [43], the maximum number of profiles in FMM should be equal to the number of profiles in the best LPA solution. Therefore, we extracted a FMM solution with up to four profiles with all observed indicators loading on the same continuous latent factor. Unfortunately, none of the solutions converged properly, mostly because of nonpositive definite matrices. Further examination of the inadmissible FMM solutions revealed latent profiles again parallel to one another, suggesting that the analysis might be unable to separate the variance because of qualitatively distinct profiles from the variance due to the continuous latent variable. This could happen when there were actually no qualitatively meaningful profiles in the data.

We therefore concluded that the Dark Triad was best measured as a continuous variable. Based on LPA, CFA, and FMM, this was the most parsimonious interpretation of the data.

Nomological network with Big Five personality measures and SDO

Finally, we related the Dark Triad with external variables—the Big Five and SDO—to determine whether the person-centered approach provided incremental information above the variable-centered approach (Table 2). Only results significant at $\alpha < .001$ were shown because of the large sample size.

Table 2. Construct correlations with external variables (for variable-centered approach solution) and mean comparison among profiles on external variables (for person-centered approach solution).

	Dark Triad factor score	Psychopathy residual	Machiavellianism residual	Narcissism residual
Variable-centered approach				
Openness	-.10***	-.04	-.04	.17***
Conscientiousness	-.26***	-.18***	.05	.31***
Extraversion	.10	.01	-.28***	.60***
Agreeableness	-.61***	-.03	-.05	.19***
Neuroticism	.18***	.08	.06	-.31***
SDO	.53***	-.11***	.12***	-.003
	High	Middle	Low	
3-profile solution				
Openness	3.46	3.45	3.61	
Conscientiousness***	3.25$_a$	3.46$_a$	3.76$_b$	
Extraversion	3.56	3.48	3.32	
Agreeableness***	3.21$_a$	3.82$_b$	4.13$_c$	
Neuroticism***	2.92$_a$	2.53$_b$	2.50$_b$	
SDO***	3.47$_a$	2.50$_b$	1.98$_c$	
	High	Middle	Middle-Low	Low
4-profile solution				
Openness***	3.76$_{ab}$	3.36$_a$	3.49$_{ab}$	3.68$_b$
Conscientiousness***	3.56$_{abc}$	3.19$_a$	3.47$_b$	3.92$_c$
Extraversion	3.86	3.46	3.50	3.23
Agreeableness***	2.68$_a$	3.27$_b$	3.84$_c$	4.24$_d$
Neuroticism***	2.94$_{ab}$	2.91$_a$	2.55$_b$	2.52$_b$
SDO***	4.20$_{ab}$	3.41$_b$	2.50$_c$	1.80$_d$

$N = 1,102$.

***$p < .001$ for correlations (for variable-centered approach) and significantly differences among profiles (for person-centered approach). Numbers with different subscripts have statistically different means. Due to large sample size, only results with $p < .001$ are shown.

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Under the variable-centered approach, we correlated the Dark Triad with those external variables. Replicating previous research, we found that the Dark Triad correlated best with agreeableness (r = -.61) and SDO (r = .53), followed by conscientiousness (r = -.26). Profile differences on those external variables revealed similar trends: the high Dark Triad group tended to have the lowest levels of agreeableness, and a high (though not always significantly the highest) level of SDO. The results with conscientiousness were a bit ambiguous–in both 3- and 4-profile solutions, the high Dark Triad group did not differ with other groups in terms of conscientiousness. In the 3-profile solution, the mean difference between the high and the middle groups in conscientiousness was not large (3.25 vs. 3.46). In the 4-profile solution, this result was partly because of the large estimated standard error in the high group (SEs = .16 in the high group vs. the average of .05 in other groups). As a result, the large standard errors were also found for the estimated means of all other external traits in the high group. Overall, the results from the variable-centered approach were consistent with those from the person-centered approach–the profile solutions showed the best ability to discriminate among groups in an external trait when the trait also had the highest correlations with the overall Dark Triad factor score.

In the four-profile solution, the exceptionally large standard error in the high group often indicated the potential problem of over-extraction. Uncertainty in estimating the means with external variables could occur when the LPA had high classification uncertainty (i.e., low entropy): The analysis could not confidently assign an individual to a group. Indeed, even for the 4-profile solution, the entropy value was quite low (.68) and rather far away from the perfect classification entropy of 1. Overall we did not see that the profile solutions provided much additional information beyond the variable-centered approach.

Discussion and Implications

Variable-centered approaches assume the absence of qualitatively (categorically) different subpopulations in a sample. Previous researchers have often employed a variable-centered approach in their empirical examination without explicitly testing this assumption. The current research thus provides a timely addition to the literature of the Dark Triad. Despite the increasing popularity of person-centered approaches in psychological measurement (e.g., PTSD, ADHD, organizational commitment, school bullying), the present results failed to demonstrate the superiority of the person-centered approach beyond the existing variable-centered approach. Therefore, our findings failed to support recent suggestion of using person-centered approach to analyze the Dark Triad constructs [52].

There are three key findings. First, fit indices such as BIC, the best indicator to select a latent variable model, showed that LPA solutions did not fit much better than CFA solutions. Second, the LPA profile solutions showed parallel shapes, meaning that the profiles differed only quantitatively, not qualitatively. Third, the nomological network investigation showed that the profile solutions did not provide incremental useful information beyond the variable-centered solutions. Based on the principle of parsimony, the results taken together favor the variable-centered approach: Participants in the sample are quantitatively different on the Dark Triad constructs, but they are qualitatively homogeneous. This appeared to align with Jonason and Jackson's [38] finding that all three Dark Triad traits were correlated with negative affectivity, reward sensitivity, and dysfunctional impulsivity in a similar pattern, implying that Dark Triad traits could be driven by a common set of factors. Therefore, the Dark Triad is best measured as a dimensional variable, at least with student populations that share substantial demographic characteristics such as ours (mostly Caucasian young adults who are well educated in North America).

Although our results showed that the Dark Triad traits are best conceptualized as continuous constructs, we should emphasize that our latent profile analysis has provided further insight to the nature of the Dark Triad. Our latent profile results (Fig 2) revealed clearly that individuals high in one member trait of the Dark Triad (e.g., psychopathy) also tended to score high in other traits. This finding is consistent with our CFA results, in which each trait (particularly Machiavellianism and psychopathy) has a sizeable factor loading on the overall latent construct of Dark Triad. Even though researchers may occasionally make person-centered predictions (e.g., individuals high on the Dark Triad will do A), the Dark Triad traits are closely related to each other rather than being three distinct variables. Therefore, it may be appropriate to make inferences to individuals by modeling the overall latent construct of Dark Triad using a CFA procedure, rather than treating the three Dark Triad traits as distinct variables. The overall latent construct would represent individuals' standing on this construct.

Limitations

As with any research, the current research has certain limitations. First, as mentioned, our sample is predominantly Caucasian university students studying in North America. Due caution should be taken before generalizing the results to other populations. On the other hand, because the Dark Triad concept emerged mainly from research with subclinical populations, the current sample provides continuity with previous research. Still, for researchers who are interested in studying the Dark Triad constructs at the clinical level, our results may not generalize to this specific population. Further LPA and FMM research using both clinical and non-clinical populations is required to determine the relative merits of person- vs. variable-centered (or hybrid) approaches.

A second limitation is the current study's reliance on self-report data. When people try to tell others about themselves, a certain amount of self-presentation bias is inevitable: He and van de Vigner [78] confirmed the existence of self-presentation bias in self-report data across domains, including personality. Because Dark Triad items are probably vulnerable to such bias [39], we must move beyond self-rating measures to concrete behavior [79] when examining the Dark Triad.

Finally, a few researchers have begun to study the Dark Tetrad—the Dark Triad plus sadism. Sadism has been shown to predict social aversive behaviors above and beyond those Dark Triad subconstructs [2, 80–82]. Future research may continue to examine the utility of incorporating sadism into the Dark Triad and to examine the data structure of sadism using both variable- and person-centered approaches.

Conclusion

Allport [49], back in 1937, insightfully pointed out psychological processes as a coordinated rather than isolated system, and thus it may be appropriate to use individuals with various profile configurations, not independent traits, as the unit of analysis. The current research followed Allport's recommendation to examine the appropriate analytic approach for the Dark Triad. On one hand, LPA solutions showed quantitatively parallel profiles, meaning that individuals scoring high on one trait are very likely to possess other traits' qualities. The Dark Triad traits should thus be studied using variable-centered approach. On the other hand, LPA solutions suggested that the three traits may not be three distinct characteristics because individuals scoring high on one trait also tend to be strong in other Dark Triad traits. Thus our results supported the modeling of an overall, higher-level construct (with confirmatory factor analysis, for example) to represent individuals' standing on the Dark Triad (i.e., making person-centered predictions). Finally, we reiterate that the assumption was examined only in a North American

student population. Thus this paper may act as an example of how the assumption may be tested in another population.

Author Contributions

Conceptualization: CCSK.

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References

1. Paulhus DL, Williams KM. The dark triad of personality: Narcissism, Machiavellianism, and psychopathy. Journal of Research in Personality. 2002; 36(6): 556–563.

2. Furnham A, Richards SC, Paulhus DL. The Dark Triad of personality: A 10 year review. Social and Personality Psychology Compass. 2013; 7(3): 199–216.

3. Holtzman NS, Strube MJ. Narcissism and attractiveness. Journal of Research in Personality. 2010; 44 (1): 133–136.

4. Holtzman NS, Strube MJ. People with dark personalities tend to create a physically attractive veneer. Social Psychological and Personality Science. 2013; 4(4): 461–467.

5. Holtzman NS, Vazire S, Mehl MR. Sounds like a narcissist: Behavioral manifestations of narcissism in everyday life. Journal of Research in Personality. 2010; 44(4): 478–484. PMID: 20711512

6. Jonason PK, Webster GD, Schmitt DP, Li NP, Crysel L. The antihero in popular culture: Life history theory and the dark triad personality traits. Review of General Psychology. 2012; 16(2): 192–199.

7. Jonason PK, Li NP, Webster GD, Schmitt DP. The dark triad: Facilitating a short-term mating strategy in men. European Journal of Personality. 2009; 23(1): 5–18.

8. Jonason PK, Kavanagh P. The dark side of love: Love styles and the Dark Triad. Personality and Individual Differences. 2010; 49(6): 606–610.

9. Jones DN, Figueredo AJ. The core of darkness: Uncovering the heart of the Dark Triad. European Journal of Personality. 2013; 27(6): 521–531.

10. Lee K, Ashton MC, Wiltshire J, Bourdage JS, Visser BA, Gallucci A. Sex, power, and money: Prediction from the Dark Triad and Honesty–Humility. European Journal of Personality. 2013; 27(2): 169–184.

11. Campbell WK, Foster JD. The narcissistic self: Background, an extended agency model, and ongoing controversies. In: Sedikides C and Spencer S J, editors. The self: Frontiers of social psychology; 2007. pp. 115–138. New York: Psychology Press.

12. Raskin R, Novacek J. Narcissism and the use of fantasy. Journal of Clinical Psychology. 1991; 47(4): 490–499. PMID: 1939692

13. Blair RJR, Viding E. Psychopathy. In: Rutter M, Bishop D, Pine D, Scott S, Stevenson J, Taylor E, et al, editors. Oxford, United Kingdom: Blackwell; 2008. pp. 852–863

14. Marsh AA. What can we learn about emotion by studying psychopathy?. Frontiers in Human Neuroscience. 2013; 71(7): 1–13.

15. Hare RD. Without conscience: The disturbing world of the psychopaths among us. New York: Pocket Books; 1993.

16. Patrick CJ. Emotion and psychopathy: Startling new insights. Psychophysiology. 1994; 31(4): 319–330. PMID: 10690912

17. Christie R, Geis FL. Studies in Machiavellianism. New York: Academic Press; 1970.

18. Gunnthorsdottir A, McCabe K, Smith V. Using the Machiavellianism instrument to predict trustworthiness in a bargaining game. Journal of Economic Psychology. 2002; 23(1): 49–66.

19. Wilson DS, Near D, Miller RR. Machiavellianism: A synthesis of the evolutionary and psychological literatures. Psychological Bulletin. 1996; 119(2): 285. PMID: 8851275

20. Vecchio RP, Sussmann M. Choice of influence tactics: Individual and organizational determinants. Journal of Organizational Behavior. 1991; 12(1): 73–80.

21. Ryckman RM, Thornton B, Butler JC. Personality correlates of the hypercompetitive attitude scale: Validity tests of Horney's theory of neurosis. Journal of Personality Assessment. 1994; 62(1): 84–94. PMID: 8138889

22. Foster JD, Campbell WK. Are there such things as "narcissists" in social psychology? A taxometric analysis of the Narcissistic Personality Inventory. Personality and Individual Differences. 2007; 43(6): 1321–1332.

23. Meehl P, Golden R. Taxometric methods. In: Kendall P., Butcher J., editors. Handbook of research methods in clinical psychology. New York: Wiley; 1982. pp. 127–181.

24. Ahmed AO, Strauss GP, Buchanan RW, Kirkpatrick B, Carpenter WT. Are negative symptoms dimensional or categorical? Detection and validation of deficit schizophrenia with taxometric and latent variable mixture models. Schizophrenia Bulletin. 2014; 41: 879–891. doi: 10.1093/schbul/sbu163 PMID: 25399026

25. Harris GT, Rice ME, Quinsey VL. Psychopathy as a taxon: Evidence that psychopaths are a discrete class. Journal of Consulting and Clinical Psychology. 1994; 62(2): 387–397. PMID: 8201078

26. Trull TJ, Durrett CA. Categorical and dimensional models of personality disorder. Annual Review of Clinical Psychology. 2005; 1: 355–380. PMID: 17716092

27. Dickinson KA, Pincus AL. Interpersonal analysis of grandiose and vulnerable narcissism. Journal of Personality Disorders. 2003; 17(3): 188–207. PMID: 12839099

28. Russ E, Shedler J, Bradley R, Westen D. Refining the construct of narcissistic personality disorder: Diagnostic criteria and subtypes. American Journal of Psychiatry. 2008; 165(11): 1473–1481. doi: 10.1176/appi.ajp.2008.07030376 PMID: 18708489

29. Falkenbach D, Poythress N, Creevy C. The exploration of subclinical psychopathic subtypes and the relationship with types of aggression. Personality and Individual Differences. 2008; 44(4): 821–832.

30. Guay JP, Ruscio J, Knight RA, Hare RD. A taxometric analysis of the latent structure of psychopathy: Evidence for dimensionality. Journal of Abnormal Psychology. 2007; 116(4): 701–716. PMID: 18020717

31. Hicks BM, Markon KE, Patrick CJ, Krueger RF, Newman JP. Identifying psychopathy subtypes on the basis of personality structure. Psychological Assessment. 2004; 16(3): 276–288. PMID: 15456383

32. Skeem J, Johansson P, Andershed H, Kerr M, Louden JE. Two subtypes of psychopathic violent offenders that parallel primary and secondary variants. Journal of Abnormal Psychology. 2007; 116(2): 395–409. PMID: 17516770

33. Asendorpf JB. Person-centered approaches to personality. In: Cooper ML, Larsen R, editors. Handbook of personality processes and individual differences. Washington, D.C.: American Psychological Association; 2005.

34. Kajonius PJ, Persson BN, Jonason PK. Hedonism, achievement, and power: Universal values that characterize the Dark Triad. Personality and Individual Differences. 2015; 77: 173–178.

35. Martin RA, Lastuk JM, Jeffery J, Vernon PA, Veselka L. Relationships between the Dark Triad and humor styles: A replication and extension. Personality and Individual Differences. 2012; 52(2): 178–182.

36. Turnipseed DL, Cohen SR. Academic entitlement and socially aversive personalities: Does the Dark Triad predict academic entitlement?. Personality and Individual Differences. 2015; 82: 72–75.

37. Gray JA. The neuropsychology of anxiety: An enquiry into the function of the septo-hippocampal system. Oxford University Press; 1982.

38. Jonason PK, Jackson CJ. The Dark Triad traits through the lens of Reinforcement Sensitivity Theory. Personality and Individual Differences. 2016; 90: 273–277.

39. Jonason PK, Li NP, Teicher EA. Who is James Bond? The Dark Triad as an agentic social style. Individual Differences Research. 2010; 8(2): 111–120.

40. Egan V, Chan S, Shorter GW. The Dark Triad, happiness and subjective well-being. Personality and Individual Differences. 2014; 67: 17–22.

41. Hodson G, Hogg SM, MacInnis CC. The role of "dark personalities" (narcissism, Machiavellianism, psychopathy), Big Five personality factors, and ideology in explaining prejudice. Journal of Research in Personality. 2009; 43(4): 686–690.

42. Jonason PK, Webster GD. The dirty dozen: a concise measure of the dark triad. Psychological Assessment. 2010; 22(2): 420–432. doi: 10.1037/a0019265 PMID: 20528068

43. Clark SL, Muthén B, Kaprio J, D'Onofrio BM, Viken R, Rose RJ. Models and strategies for factor mixture analysis: An example concerning the structure underlying psychological disorders. Structural Equation Modeling. 2013; 20(4): 681–703.

44. Magnusson D. The person approach: Concepts, measurement models, and research strategy. New Directions for Child and Adolescent Development. 2003; 101: 3–23. PMID: 15460974

45. Zyphur MJ. When mindsets collide: Switching analytical mindsets to advance organization science. Academy of Management Review. 2009; 34(4): 677–688.

46. Muthén B. Latent variable mixture modeling. In: Marcoulides GA and Schumacker RE, editors. New developments and techniques in structural equation modeling. Mahwah, NJ: Lawrence Erlbaum. pp. 1–33.

47. Jung T, Wickrama KAS. An introduction to latent class growth analysis and growth mixture modeling. Social and Personality Psychology Compass. 2008; 2(1): 302–317.

48. Falkenbach D M, Stern S B, Creevy C. Psychopathy variants: Empirical evidence supporting a subtyping model in a community sample. Personality Disorders: Theory, Research, and Treatment. 2014; 5 (1): 10–19.

49. Allport GW. Personality: A psychological interpretation. New York, NY: Holt; 1937.

50. Allport GW. Pattern and growth in personality. New York, NY: Harcourt College Publishers; 1961.

51. Goldberg LR. The structure of phenotypic personality traits. American psychologist. 1993; 48(1): 26–34. PMID: 8427480

52. Chabrol H, Melioli T, Van Leeuwen N, Rodger R, Goutaudier N. The Dark Tetrad: Identifying personality profiles in high-school students. Personality and Individual Differences. 2015; 83: 97–101.

53. Bollen KA. A new incremental fit index for general structural equation models. Sociological Methods and Research. 1989; 17(3): 303–316.

54. Turner K, Miller HA, Henderson CE. Latent profile analyses of offense and personality characteristics in a sample of incarcerated female sexual offenders. Criminal Justice and Behavior. 2008; 35(7): 879–894.

55. Kam CCS, Meyer JP. How Careless Responding and Acquiescence Response Bias Can Influence Construct Dimensionality The Case of Job Satisfaction. Organizational Research Methods. 2015; 18: 512–541.

56. Oppenheimer DM, Meyvis T, Davidenko N. Instructional manipulation checks: Detecting satisficing to increase statistical power. Journal of Experimental Social Psychology. 2009; 45(4): 867–872.

57. Jakobwitz S, Egan V. The dark triad and normal personality traits. Personality and Individual Differences. 2006; 40(2): 331–339.

58. Vernon PA, Villani VC, Vickers LC, Harris JA. A behavioral genetic investigation of the Dark Triad and the Big 5. Personality and Individual Differences. 2008; 44(2): 445–452.

59. Paulhus DL, Jones DN. Introducing a short measure of the Dark Triad. Poster presented at the meeting of the Society for Personality and Social Psychology, San Antonio; 2011.

60. Baughman HM, Dearing S, Giammarco E, Vernon PA. Relationships between bullying behaviours and the Dark Triad: A study with adults. Personality and Individual Differences. 2012; 52(5): 571–575.

61. Gibb ZG, Devereux PG. Who does that anyway? Predictors and personality correlates of cyberbullying in college. Computers in Human Behavior. 2014; 38: 8–16.

62. McLarnon MJW, Carswell JJ, Schneider TJ. A case of mistaken identity? Latent profiles in vocational interests. Journal of Career Assessment. 2015; 23(1): 166–185.

63. Schneider TJ, Goffin RD, Daljeet KN. "Give us your social networking site passwords": Implications for personnel selection and personality. Personality and Individual Differences. 2015; 73: 78–83.

64. Woodley HJR, Allen NJ. The dark side of equity sensitivity. Personality and Individual Differences. 2014; 67: 103–108.

65. Goldberg LR, Johnson JA, Eber HW, Hogan R, Ashton MC, Cloninger CR, et al. The international personality item pool and the future of public-domain personality measures. Journal of Research in Personality. 2006; 40(1): 84–96.

66. Pratto F, Sidanius J, Stallworth LM, Malle BF. Social dominance orientation: A personality variable predicting social and political attitudes. Journal of Personality and Social Psychology. 1994, 67(4): 741.

67. Kam C, Morin AJS, Meyer JP, Topolnytsky L. Are commitment profiles stable and predictable? A latent transition analysis. Journal of Management. 2016, 42(6): 1462–1490.

68. Morin AJS, Maïano C, Marsh HW, Janosz M, Nagengast B. The longitudinal interplay of adolescents' self-esteem and body image: A conditional autoregressive latent trajectory analysis. Multivariate Behavioral Research. 2011; 46(2): 157–201. doi: 10.1080/00273171.2010.546731 PMID: 26741327

69. Morin AJS, Maiano C, Marsh HW, Janosz M, Nagengast B. The longitudinal interplay of adolescents' self-esteem and body image: A conditional autoregressive latent trajectory analysis. Multivariate Behavioral Research. 2011; 46(2): 157–201. doi: 10.1080/00273171.2010.546731 PMID: 26741327

70. Henson JM, Reise SP, Kim H. Detecting mixtures from structural model differences using latent variable mixture modeling: A comparison of relative model fit statistics. Structural Equation Modeling. 2007; 14(2): 202–226.

71. Nylund KL, Asparouhov T, Muthén BO. Deciding on the number of classes in latent class analysis and growth mixture modeling: A Monte Carlo simulation study. Structural equation modeling. 2007; 14(4): 535–569.

72. Lubke G, Muthén BO. Performance of factor mixture models as a function of model size, covariate effects, and class-specific parameters. Structural Equation Modeling. 2007; 14(1): 26–47.

73. Bauer DJ. Observations on the use of growth mixture models in psychological research. Multivariate Behavioral Research. 2007; 42(4): 757–786.

74. Bauer DJ, Shanahan MJ. Modeling complex interactions: Person-centered and variable-centered approaches. In: Little TD, Bovaird JA, Card NA, editors. Modeling contextual effects in longitudinal studies. Mahwah, NJ: Lawrence Erlbaum; 2007. pp. 255–283.

75. de Boeck P, Wilson M, Acton GS. A conceptual and psychometric framework for distinguishing categories and dimensions. Psychological Review. 2005; 112(1): 129–158. PMID: 15631591

76. Nagin DS. Group-based trajectory modeling: An overview. In: Piquero AR, Weisburd D, editors. Handbook of quantitative criminology. New York: Springer; 2010. pp.53–67.

77. Bakk Z, Vermunt JK. Robustness of stepwise latent class modeling with continuous distal outcomes. Structural Equation Modeling; 2016; 23(1): 20–31.

78. He J, van de Vijver FJR. The value of keeping an open eye for methodological issues in research on resilience and culture In: Theron LC, Liebenberg L, and Ungar M, editors. Youth Resilience and culture. Netherlands: Springer; 2015. pp. 189–201.

79. Jones DN, Paulhus DL. Introducing the short dark triad (SD3): A brief measure of dark personality traits. Assessment. 2014; 21(1): 28–41. doi: 10.1177/1073191113514105 PMID: 24322012

80. Buckels EE, Jones DN, Paulhus DL. Behavioral confirmation of everyday sadism. Psychological Science. 2013; 24(11):2201–2209. doi: 10.1177/0956797613490749 PMID: 24022650

81. Buckels EE, Trapnell PD, Paulhus DL. Trolls just want to have fun. Personality and Individual Differences. 2014; 67: 97–102.

82. Paulhus DL. Toward a taxonomy of dark personalities. Current Directions in Psychological Science. 2014; 23(6): 421–426.